



Assessment of Natural Gas Combined Cycle (NGCC) Plants with CO₂ Capture and Storage

Mike Gravely

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California Energy Commission

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Agenda



1:00 Welcome and Introductions

Mike Gravely - Energy Commission

1:15 Overview of the Energy Commission's WESTCARB efforts

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1:35 Overview of Assessment and Demonstration of NGCC Plants with CO₂ Capture and Storage in Gas-Dominated Electricity Markets – Phase I: Assessment

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2:00 Project Task Structure & CO₂ Capture Technology Status and References

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Sienna Rogers and J Henderson – Pacific Gas and Electric Company

2:45 Geological Sequestration Opportunities in California

Elizabeth Burton – Lawrence Livermore National Laboratories

3:05 Pilot Design & Energy Commission RFP Approach

Mike Gravely - Energy Commission

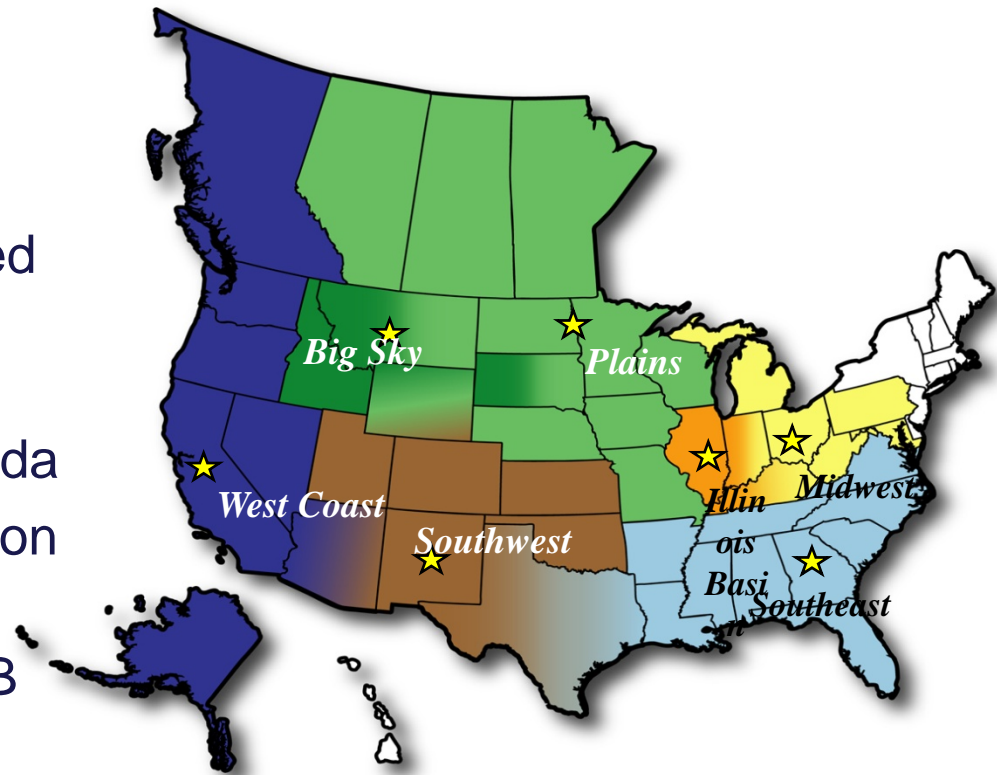
3:35 Open Discussion (Q&A)

Background

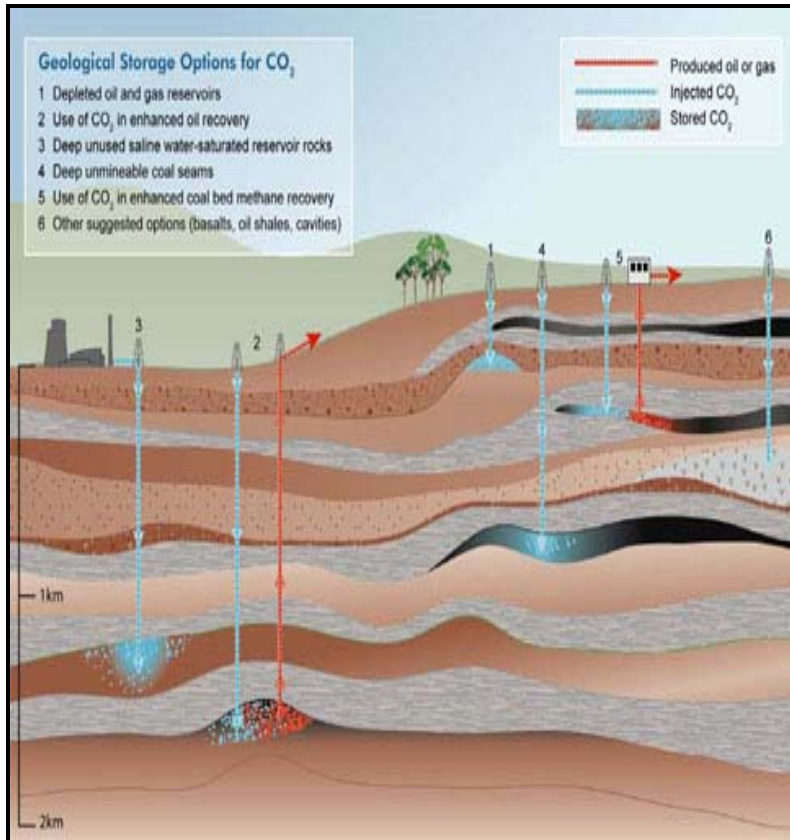


WESTCARB: One of Seven Regional Carbon Sequestration Partnerships

- DOE program initiated in 2003
- Opportunities for geologic and terrestrial CO₂ storage evaluated throughout U.S. and Canada
- Over 350 participating organizations in U.S. and Canada
- Program focus on implementation issues
- Hawaii now part of WESTCARB



What are the components of carbon capture and storage?



CO2CRC, in "Special Report on CCS,"
IPCC 2005

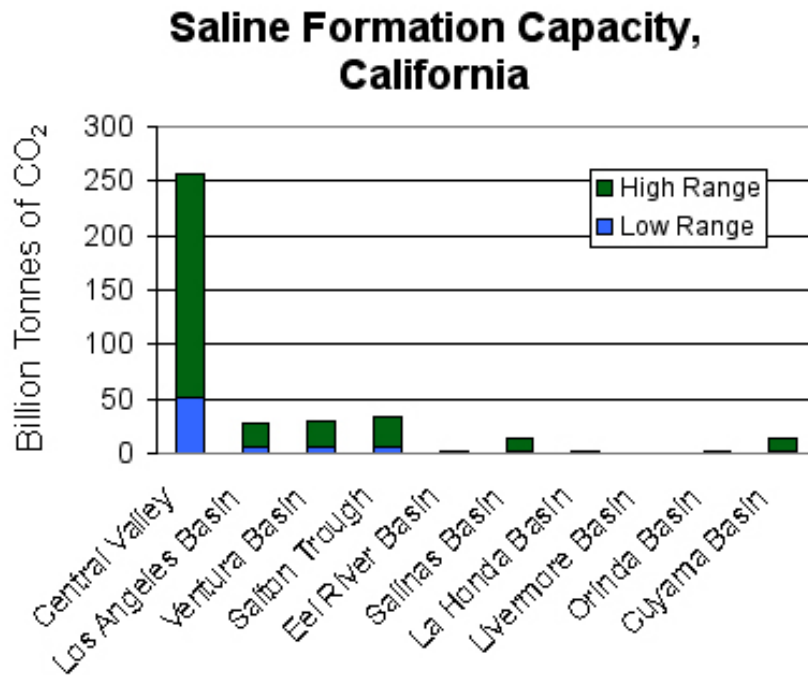
- CO₂ is “captured” from process or exhaust gases at a power plant, oil refinery, cement plant, ethanol plant, or other source
- Captured CO₂ is cleaned, dried, and compressed for injection; if not on-site, it is transported to a storage site, typically by pipeline
- CO₂ is injected as a supercritical (liquid-like) fluid for efficient storage in deep, secure geologic formations

WESTCARB Budget History

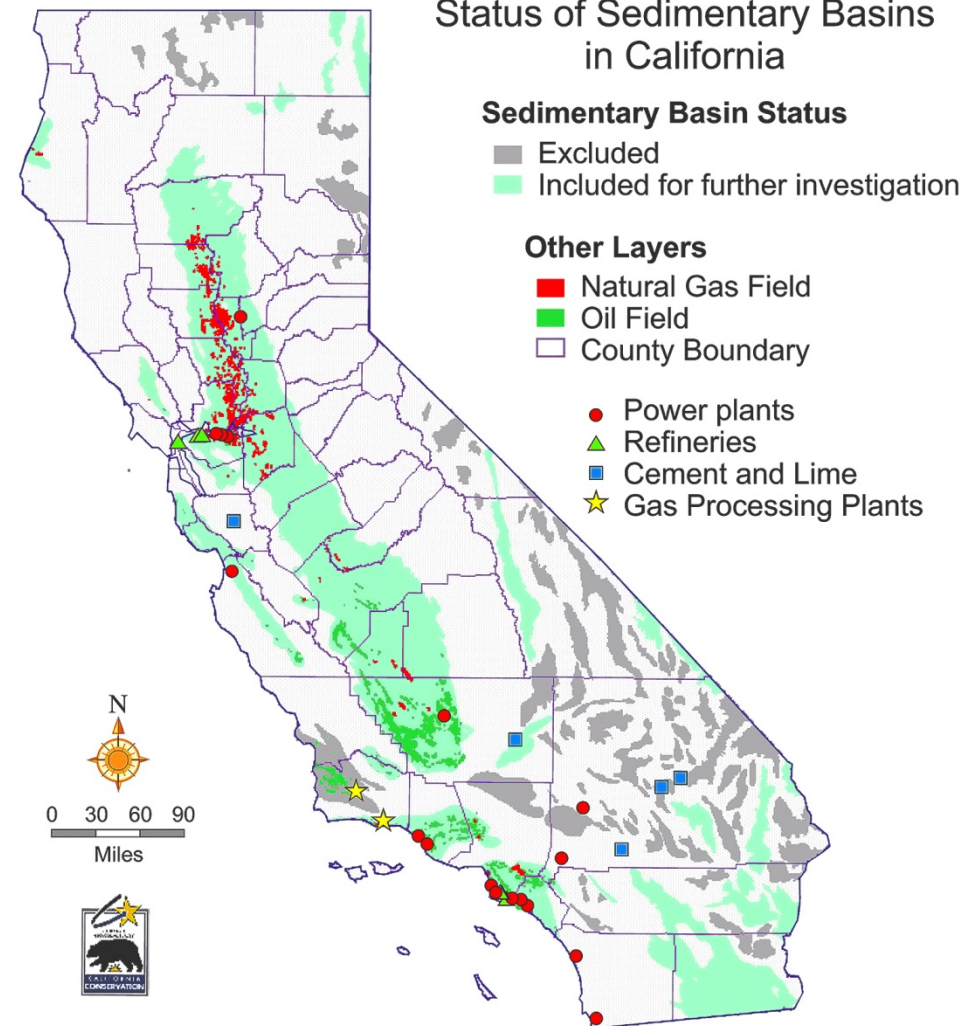


| | Phase I | Phase II | Phase III |
|-----------------------------------------------------|------------------|-------------------|-------------------|
| | 2 years | 4 years | 10 years |
| Federal – including direct funding to national labs | 1,600,000 | 17,931,100 | 65,606,584 |
| PIER** | 1,686,912 | 2,554,712 | 5,268,418 |
| Third-Party Cost Share | 264,000 | 7,896,446 | 19,719,100 |
| TOTAL | 3,550,912 | 28,382,258 | 90,594,102 |

Major Geologic Storage Opportunities in California



Gas reservoir capacity: 1.8 billion tonnes
 Oil reservoir capacity: 6.2 billion tonnes
 Saline formation capacity: 80–300 billion tonnes



WESTCARB Background



- Phase I characterized regional opportunities (Complete)
- Phase II tests promising geologic and terrestrial storage options at pilot scale (Complete 9/30/11 due to PG&E amendment)
- Phase III centers on a pre-commercial-scale geologic storage test

Phase I & II Efforts



WESTCARB Phase I Results

- Centralized GIS industrial source and CO₂ sink database
- Geologic and terrestrial storage estimates made for major sinks
- Terrestrial and geologic marginal cost curves developed
- Heightened awareness of sequestration among state, community, and industry leaders; results are informing policy
- Wealth of data for the technical and policy communities via comprehensive reports/papers

Phase II Update



Terrestrial

- 12 terrestrial afforestation pilots in Shasta county; planting completed on 10
- Two forest fuel reduction pilots completed in Oregon
- Studies continue of fire models and the ability to quantify carbon storage benefits from fuel reduction

Geologic

- Initial study completed of site-specific costs for retrofitting CO₂ capture to a pulverized coal power plant
- Study of dispatch rate and impacts of a coal power plant with CCS in the Western electric grid in final stages
- Exploratory well for initial assessment of sequestration potential at the Cholla power plant, in northeast Arizona, successfully permitted, drilled, and tested
- Surface access obtained and UIC permit filed (with USEPA) for CO₂ injection pilot project in Solano County

Phase III Objectives



- Conduct a commercial-scale CCS test (1 million tons CO₂); nominal 10-year project
 - Access the best geologic target in California
- Demonstrate commercial-scale injection site characterization, operations, maintenance, and monitoring
- Conduct research to advance technologies in reservoir modeling/simulation and engineering, risk assessment, and measurement/monitoring
- Continue regional characterization of geologic source/sink opportunities and CCS economics; project results synthesis

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Assessment of NGCC Plants with CCS



- Engineering-economic evaluation of the suitability of California NGCC plants and oilfield NG cogen/steam-flood units for CCS applications



Proposed Contract Tasks



1. Preliminary assessment of California NGCC + CCS retrofit potential and development of a screening methodology for ranking NGCC plants for CCS retrofit. Assessment of emerging and new carbon capture technologies suitable for NGCC plant.
2. Results of the screening methodology applied to California NGCC plants and preliminary site assessments and engineering—economic evaluations of CO₂ capture retrofit options for several NGCC plants in PG&E's service territory
3. A preliminary scope, cost estimate, and schedule for a pilot-scale NG-CCS technology validation test facility in PG&E's service territory

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Tentative RFP Schedule



- Release date: March 2010
- Notice of Proposed Award: May 2010
- Contract Award: August 2010

Public Information on CEC Website



Requests for Proposals, Funding Programs, Contracts, Solicitations at the Energy Commi... Page 1 of 4



Requests for Proposals, Funding Programs, Contracts, Solicitations at the Energy Commission

- [Requests of Proposed Award \(RCPA\)](#)
- [Requests of Non-Award \(RNP\)](#)
- ["No Time Limit" Solicitations](#)

Summary of Current Solicitations Listed by Due Date

| Program Area | Contract Solicitation Title and Number | Release Date | Due Date | Notice of Proposed Award Date |
|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------------------------------------------------------------------------------------------|------------------------------------------------|
| West Coast Regional Carbon Sequestration Partnership (WCRSP) | January 14, 2010 Pre-Proposal Workshop West Coast Regional Carbon Sequestration Partnership (WESTCARB) Assessment of Natural Gas Combined Cycle Plants with CO2 Capture and Storage Workshop Agenda | NA | NA | NA |
| Public Interest Energy Research (PIER) Program | Program Opportunity Notice (PON-09-002) American Recovery and Reinvestment Act Cost Share Solicitation Files Attachments to Solicitation , Posted: December 24, 2009. | 12/22/09 | 03/24/2010, 4:00 p.m. (California time) | |
| California Energy Commission American Recovery and Reinvestment Act (ARRA) | Request for Qualifications (RFQ-09-001) California Energy Commission ARRA: Measurement, Verification, Evaluation, and Reporting Solicitation Package Addendum #1 , dated December 21, 2009 Addendum #2 , dated December 24, 2009 | December 7, 2009 | January 12, 2010 3 p.m. PST | |
| 2010-2011 Investment Plan for the Alternative and Renewable Fuel and Vehicle Technology Program | Solicitation Packages for the following three areas: 1. POM-09-003 Biomethane Production for Transportation: available funding is \$21.5 million Addendum #1 Addendum #2 2. POM-09-004 Medium and Heavy Duty Advanced Vehicle Technology: available funding is \$10.8 million Addendum #1 Addendum #2 3. POM-09-006 Alternative and Renewable Fuels Infrastructure: available funding is \$9.5 million Addendum #1 Addendum #2 | 11/25/09 | January 12, 2010 by 4 p.m. PST January 26, 2010 by 4 p.m. PST | February 16, 2010 March 11, 2010 |
| Federal Economic Recovery Program ARRA Program Support Services | Notice of Applicants Workshop December 15, 2009 (PDF file) Request for Proposals RFQ-09-001 Solicitation Files Addendum #1 , dated December 4, 2009. Addendum #2 , dated December 15, 2009. Addendum #3 , posted December 21, 2009. Addendum #4 , posted December 29, 2009. Addendum #5 , posted January 12, 2010. | 11/24/09 | January 12, 2010, by 3:00 p.m. | To be announced |
| Energy Efficiency Conservation Block Grant American Recovery and Reinvestment Act of 2009 | Pre-Bid Conference - December 4, 2009 Notice of Pre-Bid Conference Solicitation Package PON 09-001 January 5, 2010 Presentation from Informa to all with last Energy Efficiency and Conservation Block Grant Prevailing Wage Compliance and Certification | 10/9/09 | January 12, 2010, 4 p.m. | To be announced. |

Public Information on CEC Website



PIER Contractors' General Information

PIER Project Report Style Manual

[Please See Style Manual Page](#)

PIER Program Sole / Single Source Contract Procedures

[Please See Procedures Page](#)

PIER Terms and Conditions

[Standard PIER Terms & Conditions](#) - complete - Date updated: February 18, 2009.

(Adobe Acrobat PDF file, 54 pages, 248 kb.)

[Standard PIER Terms and Conditions](#) - segmented - both pdf and word document form.

University of California PIER Terms and Conditions - Revision in Progress

[DOE-Laboratories PIER Terms and Conditions](#) - Link to the U.S. Department of Energy, National Laboratories PIER Terms and Conditions.

PIER Invoicing Files

[PIER Invoicing Template](#) (MS Excel file, 68 kilobytes)

[PIER Invoicing Instructions](#) (MS Word file, 71.5 kilobytes, May 2007)

[PIER Rate Adjustment Form](#) (MS Excel file, 18.5 kilobytes, May 2007)

If you are interested in the detailed Request For Proposals (RFP) or other solicitation documents, copies may be obtained by writing or calling:

Contracts Office, MS-18

California Energy Commission

1516 Ninth Street

Sacramento, CA 95814

Telephone: 916-654-4392

FAX: 916-654-4423

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Additional Comments



If you have additional comments or recommendations,
please email by January 30, 2010 to:

Elizabeth Keller: ekeller@energy.state.ca.us